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Abstract: Objective To summarize the clinical and pathologic findings in a group of dogs and cats with progressive clinical ocular disease, which were diagnosed with suppurative endophthalmitis and lens capsule rupture. Animals studied Twenty cats and forty-six dogs that underwent unilateral enucleation or evisceration for intractable uveitis and/or glaucoma. Procedure Biopsy submission requests and microscopic case material were evaluated for clinical and histological features, including history of ocular trauma, duration of ocular disease, pattern of inflammation, and the presence of intralenticular microorganisms. Results The median duration for cats and dogs was 6 and 5 weeks, respectively. A history of trauma was reported for four (20%) cats and 18 (39%) dogs. All confirmed cases of trauma—three in cats and 14 in dogs—were caused by a cat scratch. Microscopically, all cases had suppurative endophthalmitis centered on the lens, lens capsule rupture, cataract, and lenticular abscess. Infectious organisms were identified by Gram stain within the lens of 14 (70%) cats and 30 (65%) dogs. Gram-positive cocci were seen most commonly. Male cats were overrepresented as compared to females. There were no apparent gender, age or breed predilections in dogs. Conclusions A unique pattern of slowly progressive or delayed-onset endophthalmitis with lens capsule rupture, lenticular abscess, and frequently intralenticular microorganisms is associated with traumatic penetration of the globe and lens capsule. The term Septic Implantation Syndrome (SIS) is favored in lieu of 'phacoclastic uveitis' to avoid confusion with phacolytic uveitis and to clearly implicate the role of intralenticular microorganisms in the pathogenesis.
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Septic implantation syndrome in dogs and cats: a distinct pattern of endophthalmitis with lenticular abscess

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Abstract

Objective To summarize the clinical and pathologic findings in a group of dogs and cats with progressive clinical ocular disease, which were diagnosed with suppurative endophthalmitis and lens capsule rupture.

Animals studied Twenty cats and forty-six dogs that underwent unilateral enucleation or evisceration for intractable uveitis and/or glaucoma.

Procedure Biopsy submission requests and microscopic case material were evaluated for clinical and histological features, including history of ocular trauma, duration of ocular disease, pattern of inflammation, and the presence of intralenticular microorganisms.

Results The median duration for cats and dogs was 6 and 5 weeks, respectively. A history of trauma was reported for four (20%) cats and 18 (39%) dogs. All confirmed cases of trauma—three in cats and 14 in dogs—were caused by a cat scratch. Microscopically, all cases had suppurative endophthalmitis centered on the lens, lens capsule rupture, cataract, and lenticular abscess. Infectious organisms were identified by Gram stain within the lens of 14 (70%) cats and 30 (65%) dogs. Gram-positive cocci were seen most commonly. Male cats were overrepresented as compared to females. There were no apparent gender, age or breed predilections in dogs.

Conclusions A unique pattern of slowly progressive or delayed-onset endophthalmitis with lens capsule rupture, lenticular abscess, and frequently intralenticular microorganisms is associated with traumatic penetration of the globe and lens capsule. The term Septic Implantation Syndrome (SIS) is favored in lieu of 'phacoclastic uveitis' to avoid confusion with phacolytic uveitis and to clearly implicate the role of intralenticular microorganisms in the pathogenesis.

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INTRODUCTION

Traumatic penetration of the cornea or sclera often leads to acute (<1 week) and fulminant endophthalmitis. Microscop ically, cases of acute penetrating injury have widespread sup purative inflammation that is often most severe in the vicinity of the penetration site and microorganisms are occa sionally present. In cats and dogs, there is another distinct pattern of septic endophthalmitis that is associated with lens capsule rupture with fibrinosuppurative inflammation cen tered on and extending into the lens. The pattern of histo logic changes is different than acute penetrating endophthalmitis and also differs from lymphoplasmacytic endophthalmitis associated with hypermature cataract (lens induced uveitis). This difference was recognized several years ago by Wilcock and Peiffer[1] and is reviewed thor oughly by van der Woerdt.[2] They and others use the terms 'phacoclastic uveitis' for suppurative endophthalmitis because of traumatic lens capsule rupture and 'phacolytic uveitis' for the lymphoplasmacytic uveitis/endophthalmitis seen with hypermature cataract. The presumed pathogenesis of 'phacoclastic uveitis' involves an overwhelming release of lens protein and loss of T cell tolerance.[1–3] However, there is evidence of traumatic inoculation of bacteria into the lens cortex (septic implantation) for some cases of suppurative endophthalmitis with lens capsule rupture in cats and dogs.[4–6] We present a series of 46 canine and 20 feline cases submitted for histopathology to the Comparative Ocular Pathology Laboratory of Wisconsin (COPLOW) from 1998 to 2006. The term Septic Implantation Syndrome

(SIS) is favored in lieu of 'phacoclastic uveitis' to avoid confusion with phacolytic uveitis and to clearly implicate the role of intralenticular bacteria in the pathogenesis.

MATERIALS AND METHODS

Cases were selected from the COPLOW collection according to the following criteria: lens capsule rupture, the presence of intralenticular leukocytes, and inflammation clearly centered on but not necessarily limited to the lens. Excluded were cases in which lens capsule rupture was one of several abnormalities associated with severe endophthalmitis not specifically centered on the lens.

Clinical findings were extracted from the histopathology submission request form. All globes were evaluated histologically with H and E stain. A section stained according to the Brown and Brenn method (Gram stain) was available for the evaluation of all feline cases and 41 (89%) canine cases, including all cases for which bacteria could not be identified with H and E stain.

RESULTS

Included in the study were 20 feline and 46 canine cases that fit the case definition (Tables 1 and 2, respectively). Clinically apparent uveitis was reported in 14 (70%) and 16 (35%) of feline and canine cases, respectively. Cataract was reported in seven (35%) and 13 (28%) of feline and canine cases, respectively. Glaucoma was reported in 12 (60%) and 39 (85%) of feline and canine cases, respectively. Corneal disease was reported in five (25%) feline cases and 25 (54%) canine cases. All cases had inflammatory exudate centered on the lens, which was often grossly abnormal (Fig. 1). Consistently in all cases, there was lens capsule rupture, degeneration of lens fibers (cataract), and a lenticular abscess with neutrophils dissecting into the lens cortex (Figs 2 and 3). The inflammatory exudate was predominantly suppurative, composed of degenerate neutrophils and fibrin. There were often mild to moderate lymphoplasmacytic infiltrates in the iris stroma. When bacteria or fungi were present, colonies were most often embedded within the lens protein away from inflammatory infiltrates (Fig. 3).

Infectious organisms were identified within the lens of 14 (70%) cats and 30 (65%) dogs (Tables 1 and 2, respectively). The most common organisms were Gram positive cocci, seen in eight cats and 20 dogs. Gram positive rods were identified in four cats and two dogs. In two of the four cats, Gram positive rods were long and filamentous. Gram variable, morphologically variable rods were identified in two cats and two dogs. Fungal hyphae were identified within the lens of two dogs. One of those fungi was pigmented, consistent with pheochromomycosis. Organisms were not identified in six (30%) feline globes and 16 (35%) canine globes, based on histologic examination of both H and E and Gram stained sections.

A history of trauma was reported for four (20%) cats and 18 (39%) dogs. A cat scratch was the traumatic event in all cases in which the source of trauma was specified three cases in cats and 14 cases in dogs. Two (4.3%) canine cases had histologic evidence of scleral or corneal perforation. Cases were sectioned in the vertical plane and were not evaluated systematically for histologic evidence of trauma. Loss of retinal ganglion cells (evidence of glaucoma) was confirmed histologically in only two (10%) feline cases and nine (20%) canine cases.

Duration of ocular disease is defined as the time elapsed between the earliest clinical ocular signs (usually uveitis or lens opacity) and surgical intervention (enucleation or

Table 1. Summary of feline cases of septic implantation syndrome

Case #	Age (yrs)	Breed	Sex	Eye	Type of organism	Type of trauma	Duration
1	4	Domestic shorthair	M	OD	Gram + cocci	NC	1 month
2	8	Domestic shorthair	MN	OD	Gram + cocci	NC	10 days
3	12	Domestic shorthair	FS	OS	Gram + cocci	NC	Several weeks
4	1	Domestic longhair	FS	OS	Gram + cocci	NC	3 4 weeks
5	3	Domestic shorthair	MN	OS	None	NC	2 months
6	4.5	Domestic shorthair	FS	OD	Gram + cocci	NC	2 months
7	4	Persian	M	OD	Gram + rods	NC	Unknown
8	14	Domestic shorthair	FS	OS	None	NC	2 months
9	7	Domestic shorthair	MN	OS	Gram + cocci	Cat scratch	8 months
10	3	Domestic shorthair	MN	OD	Gram + rods	Cat scratch	3 weeks
11	2	Domestic shorthair	FS	OD	Gram variable rods	Cat scratch	3 weeks
12		Domestic longhair	MN	OD	Gram + long filamentous rods	Unspecified	2 months
13	4.4	Domestic medium hair	M	OS	Gram + cocci	NC	Over 2 weeks
14	3	Domestic shorthair	F	OS	Gram variable rods	NC	4 months
15	8	Domestic shorthair	MN	OS	Gram + cocci	NC	45 days
16	8	Domestic shorthair	M	OD	None	NC	2 weeks
17	7	Domestic medium hair	MN	OD	None	NC	2 months
18	12	Persian	MN	OD	Gram + long filamentous rods	NC	20 days
19	11	Domestic shorthair	MN	OD	None	NC	1 year
20	2	Devon rex	MN	OS	None	NC	Unknown

M, male; MN, neutered male; F, female; FS, spayed female; NC, not confirmed; OD, right eye; OS, left eye.

Table 2. Summary of canine cases of septic implantation syndrome

Case #	Age (yrs)	Breed	Sex	Eye	Type of Organism	Confirmed trauma	Duration
1	10	Springer spaniel mix	FS	OD	Gram + cocci	NC	26 days
2	5	Schnauzer	FS	OD	Gram variable rods	NC	8 months
3	11	Cocker spaniel	MN	OD	Gram + cocci	NC	3 weeks
4	4	Toy poodle	MN	OD	Gram + cocci	NC	3 months
5	10	Brittany spaniel	FS	OS	None	Cat scratch	2 months
6	8	Golden retriever	MN	OS	Gram + rods	NC	25 days
7	11	Mixed breed	FS	OS	Gram + cocci	NC	2 months
8	1.5	Boston terrier	M	OS	None	Unspecified	6 months
9	15	Boston terrier	FS	OD	Gram + cocci	NC	3 weeks
10	12	Yorkshire terrier	MN	OS	Gram + cocci	NC	2 3 weeks
11	5	Dachshund	MN	OD	Gram + cocci	NC	1 week
12	13	Shetland sheep dog	MN	OD	Gram + cocci	NC	Unknown
13	8	Australian shepherd	FS	OS	None	NC	2 3 weeks
14	6	Beagle	FS	OS	Gram + cocci	NC	3 weeks
15	5	Miniature poodle	FS	OS	Gram + cocci	Cat scratch	3 months
16	3	Pit bull	NC	OD	None	Unspecified	2 weeks
17	6.5	Yorkshire terrier	M	OS	Gram + cocci	Cat scratch	2 months
18	0.3	Labrador retriever	M	OS	None	Cat scratch	10 weeks
19	15	Poodle	MN	OS	Gram + cocci	NC	Months
20	3	Jack Russell terrier	M	OD	None	Cat scratch	6 weeks
21	2	Boxer	FS	OD	None	Unspecified	3 weeks
22	11	Mixed breed	MN	OS	None	NC	3 weeks
23	8.5	American eskimo	MN	OD	Gram + cocci	NC	Unknown
24	7.5	Yorkshire terrier	FS	OD	Cocci*	NC	1 2 weeks
25	12	Cocker spaniel	MN	OD	Gram + cocci	Cat scratch	3 weeks
26	0.3	Siberian husky	F	OD	None	Cat scratch	7 weeks
27	3.5	Mixed breed	MN	OS	Gram + cocci	Cat scratch	5 months
28	12	Mixed breed	FS	OS	Gram + cocci	NC	Unknown
29	2	Labrador retriever mix	FS	OD	None	NC	Over 1 month
30	5	Mixed breed	F	OS	None	NC	5 weeks
31	17	Chihuahua	FS	OS	None	NC	1 month
32	3	Cavalier King Charles spaniel	MN	OS	Gram + rods	Cat scratch	10 days
33	7	Shih tzu	FS	OS	Gram + cocci	NC	6 months
34	3.5	Maltese	MN	OD	None	Cat scratch	3 months
35	2	Weimaraner	FS	OS	Cocci*	NC	4 months
36	2.5	Labrador retriever mix	FS	OD	None	NC	Over 2 months
37	7	Beagle	FS	OS	Cocci*	Cat scratch	6 months
38	8	Labrador retriever	M	OD	Gram variable rods	NC	<1 week
39	7	Yorkshire terrier	MN	OD	Cocci*	Unspecified	8 months
40	6	French bulldog	MN	OS	Gram + cocci	Cat scratch	2 weeks
41	1.5	English setter	FS	OD	Gram + cocci and pigmented fungi	NC	7 10 days
42	10	Mixed breed	MN	OS	Gram + cocci	Cat scratch	9 weeks
43	9	Pomeranian	MN	OS	None	Cat scratch	5 weeks
44	5	Cocker spaniel mix	FS	OD	None	NC	3 weeks
45	2	Siberian husky	F	OD	Cocci and rods*	NC	>6 weeks
46	3	Greyhound	MN	OD	Fungal hyphae	NC	9 weeks

M, male; MN, neutered male; F, female; FS, spayed female; NC, not confirmed; OD, right eye; OS, left eye.
*Gram stain was not available for evaluation.

evisceration in one canine case). This duration ranged from 10 days to 1 year for cats and 1 week to 8 months for dogs. The median duration for cats and dogs was 6 and 5 weeks, respectively. Duration was unknown for two feline cases and three canine cases.

Male cats were overrepresented (14; 70%). There was no gender predilection identified for dogs. There was no clear age predilection for either cats or dogs. The mean age for cats was 6.2 years and the age range was from 1 to 14 years. The mean age for dogs was 6.7 years and the age range was 3 months to 17 years. There is no apparent predilection in either dogs or cats for breed or laterality (OD vs. OS).

DISCUSSION

Suppurative endophthalmitis in animals is often the result of a penetrating injury which may or may not damage the lens. Most cases in which bacterial colonies are seen on histopa thology are acute, fulminant, and involve all chambers of the globe. However, the underlying inflammatory trigger in SIS is thought to be traumatic implantation of microorganisms

COLOR

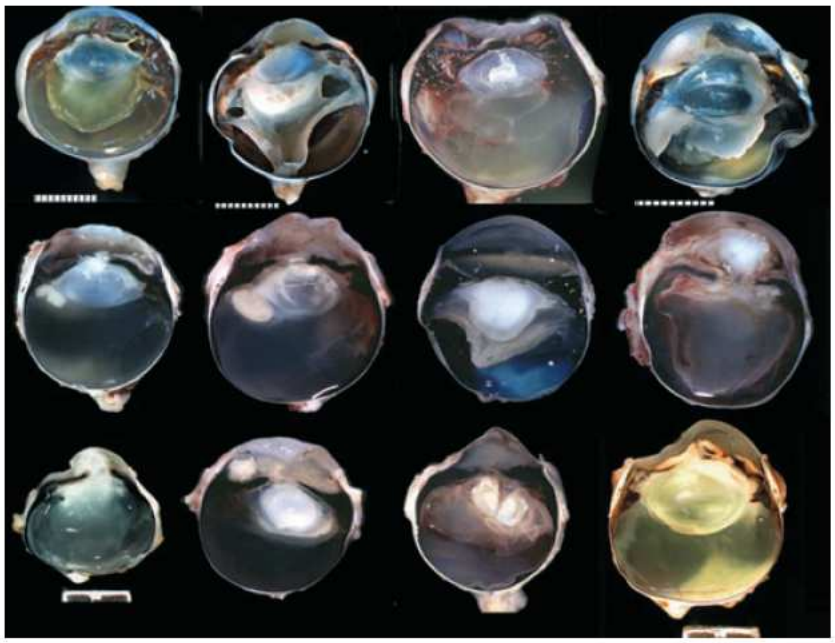

Figure 1. A collage of gross photographs of histologically confirmed cases of Septic Implantation Syndrome in cats and dogs (not all globes shown are within current case series). White to pale tan, purulent material is centered on the lens and occasionally causes a solid mass. In many of the cases, the lens is shrunken and distorted. Bar = 1 cm.

LOW RESOLUTION COLOR FIG

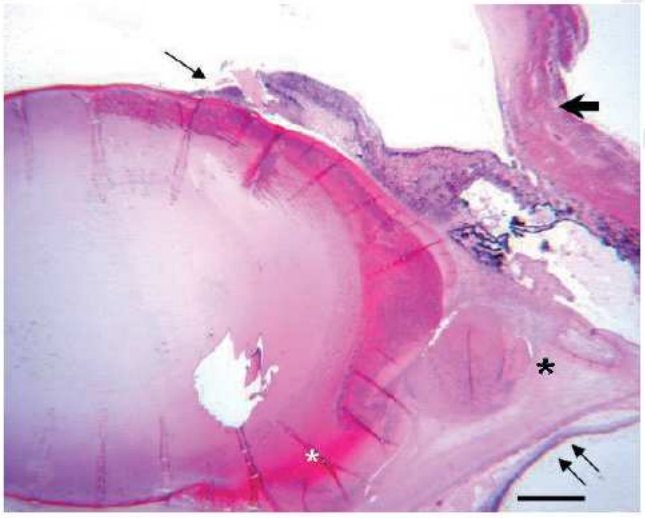

Figure 2. Globe from a dog, case 27. Low power micrograph centered on the lens, iridocorneal angle, and posterior chamber. The limbal sclera is in the upper right of the photograph (arrowhead). The equator of the lens is cradled by amorphous inflammatory exudate that occupies the posterior chamber (black asterisk). The iris leaflet is broadly molded against the anterior lens capsule, forming a posterior synechia (single arrow). The detached retina (double arrow) is molded against the pos terior surface of the exudate. There is rupture of the posterior lens cap sule with extrusion of lens protein (white asterisk). The jagged white cavity in the lens is sectioning artifact. H&E, Bar = 1 mm.

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into the lens.[5,6] In the cases presented here, Gram positive cocci were seen most frequently and the underlying cause of ocular injury was invariably a cat scratch, when the nature of the trauma was indicated. The initial corneal or scleral

LOW RESOLUTION COLOR FIG

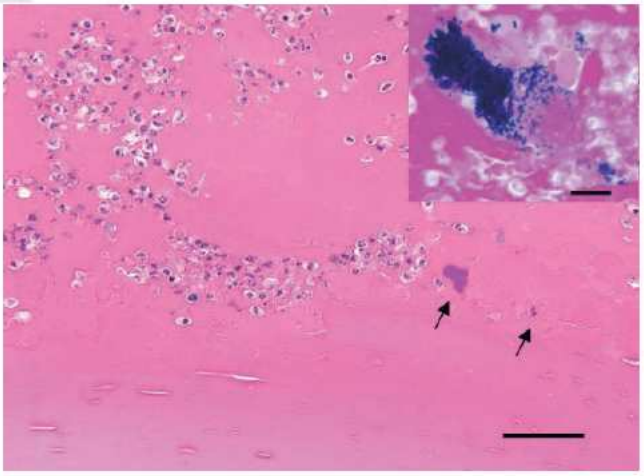

Figure 3. Globe from a dog, case 27. Neutrophils infiltrate the lens cortex with discrete bacterial colonies (arrows). H and E, Bar = 50 µm. Inset: Detail of bacteria showing coccoid morphology embedded within degenerate lens fiber protein. H and E with oil immersion, Bar = 25 µm.

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injury may heal spontaneously or remain unnoticed. If lens capsule rupture is not recognized and treated, a period of subclinical uveitis ensues, ranging from weeks to several months. The affected eye eventually develops intractable uveitis and often glaucoma, at which time enucleation may be the treatment of choice.

Clinically, SIS may be recognized as uveitis with a slowly progressive clinical course. Clinical signs may include fibrin ous exudate on the lens capsule, especially associated with a

focal cataract. The clinician may also recognize lens material in the anterior chamber and/or adhered to the lens capsule. Elevated intraocular pressure is present in most cases, although glaucoma was confirmed histologically in a rela tively small number of cases in this study.

In humans with penetrating injury associated with lens capsule rupture, the standard treatment includes early lens extraction with intracameral and systemic antibiotics.[7,8] A similar treatment regimen is expected to produce the most favorable outcome in companion animals, in terms of ocular comfort and retained vision. It is generally recommended that lens capsule ruptures >1.5 mm in length be treated with lens extraction and the surgery is most successful if per formed within 3 days of injury (vs. 10 days).[9] The key to suc cessful treatment is the early recognition and aggressive treatment of lens capsule rupture in cases of suspected trau matic penetration of the globe.

Microscopically in cases of SIS, the cellular infiltrate is predominantly suppurative and concentrated directly around the lens in the posterior chamber. The lens has corti cal degeneration (cataractous changes), although the distin guishing feature is a discontinuous lens capsule with intralenticular infiltration of neutrophils and macrophages. The site of scleral or corneal rupture is rarely appreciated histologically, because of both healing by fibrosis and plane of section. The presence of bacteria within the lens is diag nostically helpful but variable. Bacterial colonies are gener ally present in low numbers and most consistently seen embedded deep within the lens cortex, unassociated with inflammatory infiltrates.

Traumatic lenticular abscess in humans has been most fre quently reported as the result of penetrating thorns and sticks.[7,8] The characteristic histologic lesions reported in humans[7] are abscesses in the lens cortex and mild to moder ate, perilenticular exudate in the posterior chamber, similar to the cases in dogs and cats described in this publication. In one case of penetrating trauma, acute perforation of the globe was treated successfully in terms of the patient's com fort, yet routine follow up examination 1 week later revealed exuberant fibrinous reaction with posterior syne chia.[10] In human cases, *Staphylococcus epidermidis* was most frequently isolated from culture and less frequently isolated bacteria included *Staphylococcus aureus*[8] and *Pseudomonas* sp.[7] Fungal organisms that were isolated included *Aspergillus* sp., *Bipolaris* sp., and *Cladosporium* sp.[7] There are individual reports of traumatic lenticular abscesses in humans, one caused by a cat scratch and one as a result of a rooster peck, in which cases *Pseudomonas* sp.[10] and *Streptococcus* sp.[11] were isolated, respectively. In the current study, all know cases of trauma were a cat scratch and no samples were submitted for microbiological testing. Outside of the dataset for this study, the COPLOW collection includes one case of SIS in a cat caused by a raccoon scratch (Dubielzig, personal communi cation), and a case of SIS in a dog in which the lens abscess was treated with phacoemulsification and culture yielded *Moraxella* sp. (J. Urbanz, personal communication).

Key differences in clinicopathologic presentation and pathogenesis distinguish SIS from lens induced uveitis in dogs (Table 3). Lens induced uveitis is believed to be because of a cell mediated response to liberated lens protein from the cataractous lens.[1–3] As such, the inflammatory infil trate is generally lymphoplasmacytic and concentrated within the anterior uveal stroma. The lens has features char acteristic of a mature to hypermature cataract, including undulant but intact lens capsule, posterior migration of lens epithelium, degeneration of lens fibers (Morgagnian glob ules and bladder cells), and occasional mineralization. For mation of fibrovascular membranes, posterior or anterior synechia and secondary neovascular or angle closure glau coma are common sequelae in chronic stages.

The term phacoclastic uveitis has been used to describe a pattern of disease in dogs with characteristic features of SIS, including long duration between injury and onset of uveitis, as well as suppurative intralenticular and perilenticular infil trates.[1] To avoid confusion between SIS and lens induced uveitis (phacolytic uveitis), we prefer to avoid the term phac oclastic uveitis. Furthermore, it is appropriate to reserve the term phacoclastic uveitis for cases of sterile lens capsule rup ture in which loss of T cell tolerance is the presumed mech anism of inflammation.

Traumatic intralenticular abscesses are reported in humans, although none of the reports cited provide histo pathology of the affected globe. This study provides a description of histopathologic changes and description of

Table 3. Features of lens induced uveitis vs. septic implantation syndrome

	Features of Lens induced Uveitis	Features of Septic Implanation Syndrome
Primary inflammatory cells	Lymphocytes and plasma cells	Neutrophils*
Distribution of inflammation	Anterior uveal tract	Posterior chamber (perilenticular)
Lens capsule	Wrinkled but intact	Ruptured
Lens cortex	Cataractous change	Inflammatory cells (abscess), liquefaction of fibers, ± micro organisms
Morphologic evidence or history of trauma	None	Generally present
Presumed pathogenesis	Release of lens protein	Presence of bacterial antigens
Sequelae	Neovascular glaucoma	Endophthalmitis ± glaucoma

*Perivascular lymphoplasmacytic infiltrates are also seen in the anterior uveal tract.

intralenticular microorganisms. This case series suggests that a lens abscess may develop weeks to months after traumatic inoculation of microorganisms into the lens, which leads to a pattern of endophthalmitis that is distinctly different than the pattern seen with lens induced uveitis. There is currently no satisfactory explanation for the prolonged duration between a traumatic event and onset of clinically apparent lens abscess and endophthalmitis. Male cats are overrepresented, presumably because they are more likely to fight with and be injured by other cats.

REFERENCES

1. Wilcock BP, Peiffer RL. The pathology of lens induced uveitis in dogs. *Veterinary Pathology* 1987; **24**: 549 553.
2. van der Woerdt A. Lens induced uveitis. *Veterinary Ophthalmology* 2000; **3**: 227 234.
3. Hendrix DVH. Diseases and surgery of the canine anterior uvea. In: *Veterinary Ophthalmology*, 4th edn (ed. Gelatt KN) Blackwell, Ames, 2007; 812 858.
4. Dubielzig RR, Pirie CG. Septic implantation syndrome: analysis of 29 canine and 11 feline cases. *36th Annual Meeting of the American College of Veterinary Ophthalmologists* 2005; **21**: ??? ???. 4
5. Dalesandro N, Stiles J, Miller M. Septic lens implantation syndrome in a cat. *Veterinary Ophthalmology* 2011; **14**(s1): 84 87.
6. Dubielzig RR, Ketring KL, McLellan GJ *et al. Veterinary Ocular Pathology: A Comparative Review*. Saunders Elsevier, Edinburgh, 2010.
7. Rajaraman R, Lalitha P, Raghavan A *et al.* Traumatic lenticular abscess: clinical description and outcome. *American Journal of Ophthalmology* 2007; **144**: 144 146.
8. Salman A, Parmar P, Philip VR *et al.* Traumatic intralenticular abscess: a case series. *Clinical and Experimental Ophthalmology* 2007; **35**: 252 255.
9. Davidson MG, Nasisse MP, Jamieson VE *et al.* Traumatic anterior lens capsule disruption. *Journal of the American Animal Hospital Association* 1991; **27**: 410 414.
10. Kovach JL, Maguluri S, Recchia FM. Subclinical endophthalmitis following a rooster attack. *Journal of the American Association for Pediatric Ophthalmology and Strabismus* 2006; **10**: 579 580.
11. Doi M, Ikeda T, Yasuhara T *et al.* A case of bacterial endophthalmitis following perforating injury caused by a cat claw. *Ophthalmic Surgery and Lasers* 1999; **30**: 315 316.